IRAN NANO TECHNOLOGY PRODUCTS AND EQUIPMENT

Raw material, Services and Industrial Supplies

2021-2022

5

God willing, the country will see your progress and this direction of work toward market and wealth is very important. It means that this knowledge-based companies can literally use this program. This will make your scientific and research work more effective in people living environment. This is a guarantee of your work advances.

Part of statement by Supreme Leader of Islamic Revolution to the nanotechnology family, 31th January, 2014.


The perspective of
IRAN NANO
products and market

In the twenty-year perspective of the country (2006-2026), Islamic republic of Iran has been considered a developed country, having the first place of economic, science and technology between the countries nearby, inspiring in Islamic world and having acceptable and effective interaction with the international community. Accordingly, the Iran Nanotechnology Innovation Council was established in 1382 to build coordination and create synergy between the executive headquarters of the country. The viewpoint of Iran Nanotechnology Innovation Council to develop(promote) nanotechnology was the development of a long-term activity framework of Iran in this field, so the first ten-year strategic program of nanotechnology was prepared and then passed by the government cabinet.

In the first ten-year, going forward to this perspective, some effective steps were taken and a pattern of scientific and targeted movements toward the development of nanotechnology was obtained.

In this document, attempts have been made to keep the goals and the way achieving them updated so that the country pioneering in this newfound technology continues better than before.

The document of the nanotechnology development has been compiled based on the evaluations of the first ten-year document implementation and its feedbacks and also based on new approaches and policies in the development of science and technology.

In the new era (nowadays), the main goals are increasing the country scientific authority, developing the nano industry and market and role-playing of this technology in the people's lives.

According to this view, nanotechnology advances in Islamic Iran would improve people's quality of life by having impact on the country developments and producing wealth until the year 1404. Due to this approach, a perspective (overview) and three main goals have been considered for the second ten-year nano advances in the country which are as follows:

Increasing the impact of nanotechnology on improving of people's quality of life.

Attainment of the country to an appropriate position in nanotechnology and science throughout the world.

Getting a proper share of the nanotechnology global market.

INTRODUCTION

Iran nanotechnology products book

Nanotechnology advances with the aim of producing wealth and improving people's quality of life have led to the production of various industrial products in different fields. For introducing industrial products which have nanoscale certificates, the eighth edition of books relating to nanotechnology products and equipment have been published in six volumes. In the present book (first volume), products related to buildings, paints and resins and home appliances are introduced.

Iran nanotechnology assessment unit

The assessment unit of Iran nanotechnology products was established with the support of Iran Nanotechnology Innovation Council in 1386 to increase customers' trust and improve nano products quality. The main mission of this unit is evaluating properties of a product, approving the product being nanoscale and granting a nanoscale certificate. Checking more than 2000 cases and giving certificates to more than 450 products is one of the achievements attributed to this unit over years.

The product assessment unit services

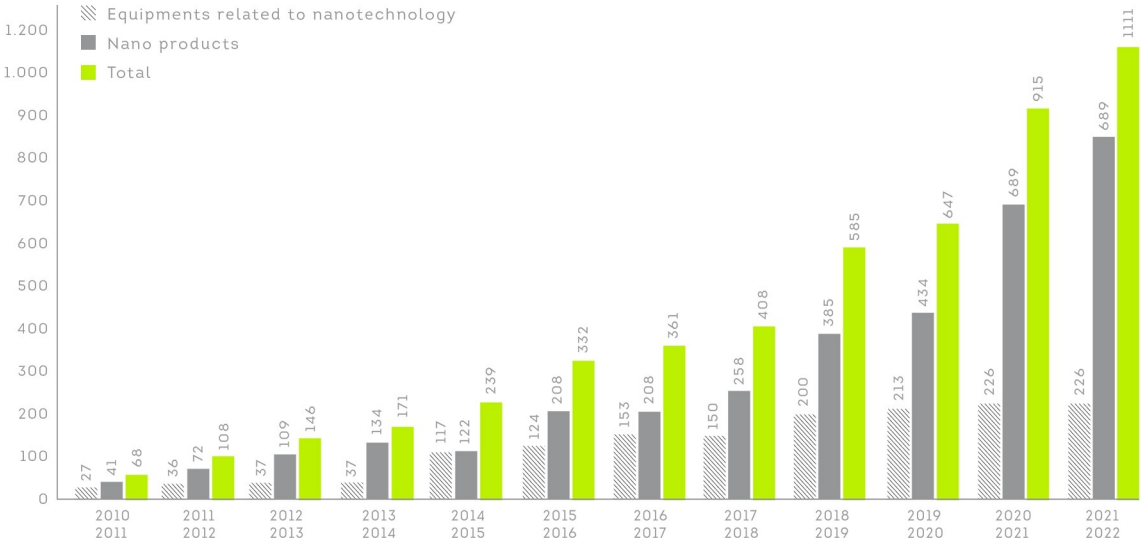
- Preliminary assessment (evaluation) of nanotechnology product technical documents
- Inspecting and granting nanoscale certificates
- Giving support for the product characterization and completion of technical documents
- Giving support to do operational tests and to get technical verifications
- Giving support to do quality control tests for nano B2B products
- Monitoring the market of nano products
- Creating a database of nano products and companies
- The supports of Iran Nanotechnology Innovation Council and the Corridor from companies having nanoscale certificates.

Nonotechnology product indicators

According to the international standard ISO/TS8004 and the national standard 21145 (Naotechnology, words and terms and main definitions) nanotechnology product is a product which its applications and properties is based on nanotechnology or improved by nanotechnology.
Products having three conditions listed below are named nanotechnology products:
1. Nanotechnology or nanoscale scientific knowledge (1-100nm) is used in them.
2. The product applications and properties are improved by nanotechnology.
3. The product production process is based on engineering.

Products which are counted nanotechnology products according to standard ISO/TS8004 and the national standard 21145, are given nanoscale certificates after being assessed and examined with some related tests.
Nanoscale certificates are issued with one-year validity which can be extended.
Moreover, during the validity of the certificate, periodic inspections are done to insure the product stability of scale and properties.
Nanoscale pilot(test) certificates are given to technologies and product which have just met some technical requirements but not the production and trade requirements existing in the institute bylaw such as product and utilization license, active quality control unit and other required licenses.

The number of nanotechnology products and equipments



Statistics related to nanotechnology products and equipments which took nanoscale certificates until 20 June 2020.

Total nano products and equipments

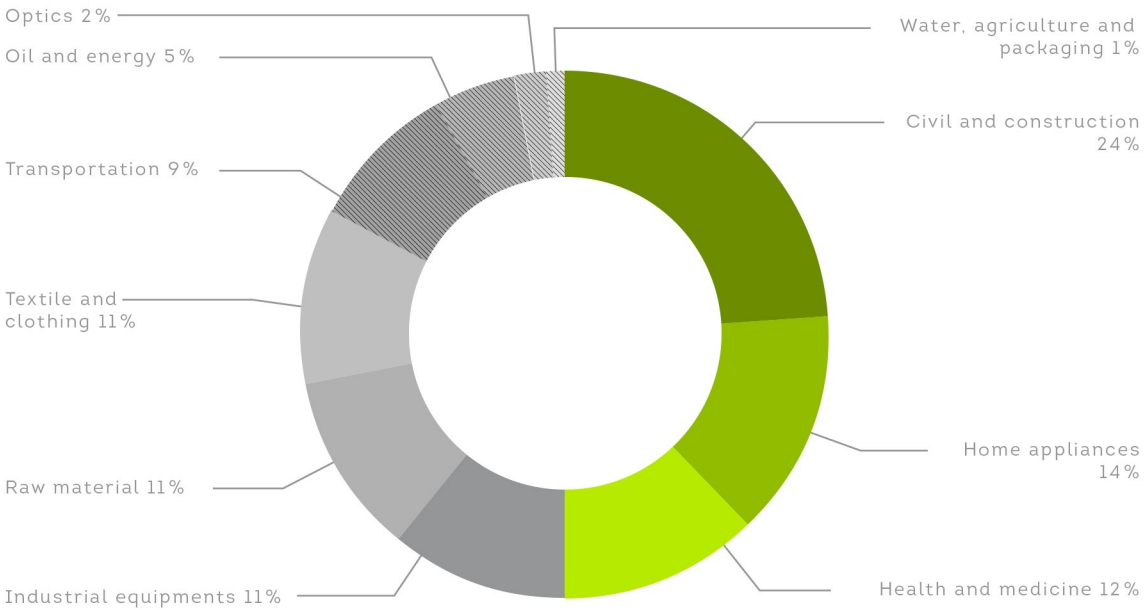
Products		Equipments		Total
689	+	226	=	915

Manufacturing companies of nano products and equipments

Products		Equipments		Total
261	+	61	=	322

Industrial domain of products having nanoscale certificates

Industrial domain of products having nanoscale certificates



The export target countries of Iran nano products in 2017

Syria	Japan	Croatia
Iraq	India	Kuwait
Oman	Azerbaijan	Georgia
Kazakhstan	Austria	Poland
Qatar	Armenia	Lithuania
Canada	Uzbekistan	Greece
Bulgaria	Emirates	Turkey
Bolivia	England	China
Pakistan	Ukraine	Russia
Tajikistan	Italy	Romania
Thailand	Germany	Afghanistan
Turkmenistan	Brazil	Malaysia

PRODUCTS

Raw Material

Services

Industrial Supplies

RAW MATERIAL

ALUMINA POWDER

Ardakan Industrial Ceramics Company (A.I.C) www.aic.ir

Description

This product is an activated aluminium oxide catalyst modified by a metallic dopant. It can be used in the Claus process regardless the amount of oxygen present in the atmosphere.

Nanotechnology-driven advantages

The exploitation of nanotechnology in the structure of this product has resulted in:

- Reduction of excessive oxygen content in the Claus process
- Prevention of catalyst inactivation

Applications

- Catalyst for the Claus process

NANOSTRUCTURED SILICA POWDER

Novin Fadak Sepahan

www.fadakgroup.ir

Description

These products are silica nanoparticles of superficial nanometric porosity which are supplied in both A4 and A7 grades. They benefit a uniform particles size distribution and high surface area, thereby being used as suitable additive for a wide variety of material systems.

Nanotechnology-driven advantages

The utilization of the nanotechnology synthesis method has created the possibility to produce nanoparticles with:

- High surface area
- Superficial nancavities
- Narrow particle size distribution

Applications

For the nanopowder Grade A4:

- Reinforcement for the composite fabrication industries
- Additive for increasing the concentration of fluids
- Anti-blocking agent
- Additive for preventing the agglomeration of multiphase systems such as synthetic resins
- Agent for tailoring the rheology of industrial paints
- Appropriate alternative to bentonite in the industrial paints
- Production of epoxy-based adhesives and sealants

For the nanoparticles Grade A7:

- Anti-caking and anti-agglomeration agent
- Absorbent for liquids with 300 percent absorption capacity
- Drying agent in the production of granules
- Carrier in the production of powdery toxins

MAGNESIUM FLUORIDE NANO POWDER

Description

This product is magnesium fluoride (MgF2) powder with nanoscale particles and 97 percent purity. It benefits favorable optical properties and high surface-area-to-volume ratio.

Nanotechnology-driven advantages

The nanoscale particle size of this product and resultant surface-area-to-volume ratio have given rise to the following features:

- Low refractive index (1.38)
- High light transmittance within the UV, IR, and visible light ranges

Applications

- Raw material for catalysts and coatings
- Anti-reflective lenses, mirrors, and coatings
- Optical lenses
- Traffic cameras

ZINC SULFIDE NANO POWDER

Rayka Sanaat Afrand

www.rasatech.co

Description

This product is zinc sulfide (ZnS) powder with nanoscale rod-like particles and high purity. It benefits some nanoelectronic features including the quantum size effect, optical absorption, and quantum tunneling.

Nanotechnology-driven advantages

The nanoscale size of ZnS particles dedicates the following intrinsic characteristics to this powder:

- High surface-area-to-volume ratio
- Emergence of the quantum size effect and quantum tunneling effect
- High optical absorption

Applications

- Electrocatalysts
- Biosensors
- Optical windows
- Field-emission applications
- UV-sensors
- Chemical sensors
- Field effect transistors (FETs)
- P-type semiconductors
- Nano-generators

ZINC OXIDE NANO POWDER

Arman Jostojogaran Energy Noor — www.asepe-company.ir

Arman Nanofanavar Rabin — www.armannanotech.com

Behin Nanoparticles Pars Co. — www.behinnano.com

Description

This product is zinc oxide (ZnO) powder with nanoscale particles in the semi-equiaxed morphology. It benefits a high purity (98.5%).

Nanotechnology-driven advantages

While the average particle size of this product falls within the range of 10-20 nm, the nanostructuring gives it some specific features as follows:

- High surface-area-to-volume ratio
- Emergence of antibacterial property to eliminate the bacteria
- Absorption of unfavorable smells

Applications

- Cosmetic compounds such as sunscreens
- Fabrication of nanocomposites including rubber, glass, plastics, cement, and ceramics
- Lubricants, paints, adhesives, batteries, fire extinguishers, and UV absorbers
- Dermal and anti-allergic medicines

NANO COLLOIDAL SELENIUM (SE)

Description

This product is a uniform and stable colloid of selenium nanoparticles with a high purity (99.9%). The concentration of nanoparticles in this colloid is less than 800 ppm and can serve as a strong antioxidant.

Nanotechnology-driven advantages

The nanoscale size of particles floating in the colloid has resulted in:

- High surface-area-to-volume ratio
- Reduced toxicity compared to selenium
- High capacity of removing free radicals
- Emergence of antibacterial and antioxidation properties

Applications

- Food and pharmaceutical applications
- Cosmetics

COLLOIDAL SILVER NANOPARTICLES

Baran Shimi Pasargad
www.baranchemistry.com
Shimi Gostar Nano Mad
www.nanomad.co

Description

This product is colloidal silver nanoparticles containing silver ions and electrostatically charged spherical silver nanoparticles in a uniform colloid. It can be used in a broad spectrum of optical, antibacterial and diagnosis applications.

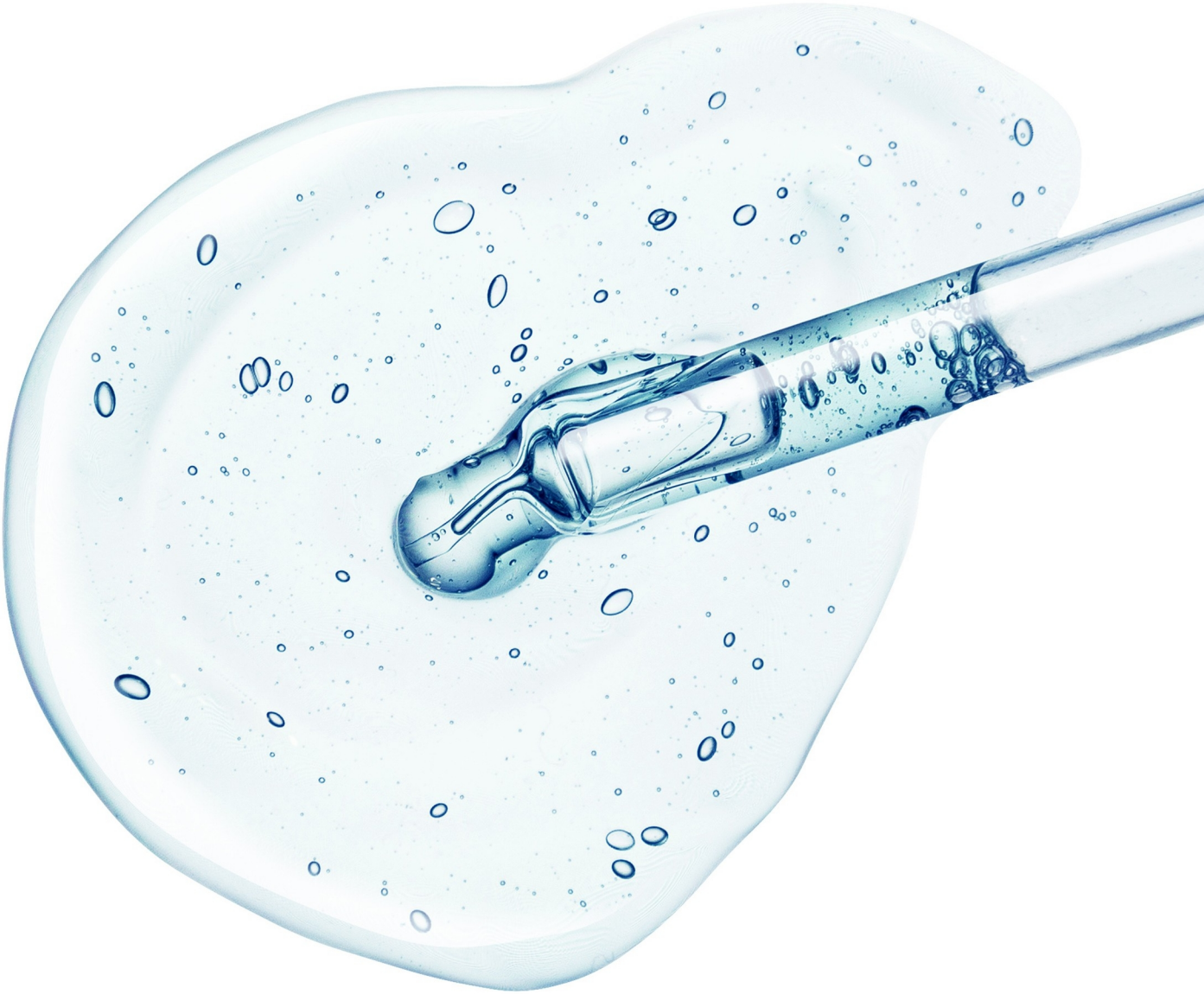
Nanotechnology-driven advantages

The nanostructuring nature of the floating particles in this colloid results in:

- Emergence of strong antibacterial-antifungal activities
- Improved electrical and thermal conductivities

Applications

- Diagnostic applications
- Conductivity-related applications
- Antibacterial applications
- Optical applications



COLLOIDAL SILICA NANOPARTICLES

Padideh Shams Iranian

Description

This family of products is chemically stabilized colloids composed of amorphous silica nanoparticles and water whose distinguishing difference arises from average particle size, solution concentration, particles morphology, and particle size distribution.

Nanotechnology-driven advantages

The exploitation of nanotechnology in this product may give rise to:

- Higher surface-area-to-volume ratio
- High chemical stability and durability

Applications

- Additive to cement for strengthening purposes
- Refractory materials for investment casting
- Polishing of silicon/sapphire wafers and optical lenses
- Decorative coatings
- Adhesives, beverage clarification, catalyst, AGM batteries, and water treatment

CARBON QUANTUM DOT BASED COLLOID

Shimi Sanat Roshd Sahand

www.shimisanat.com

Description

This product is a carbon quantum dot-based colloid, which is supplied in a gel-like form. It bears low toxicity, deserving to be used in a wide variety of applications from lubricants to electronic boards.

Nanotechnology-driven advantages

This colloid benefits the following advantage:

- Luminescence property within the range of 400-600 nm

Applications

- Lubricants
- Fluorescent paints
- Brighteners
- Cleaners
- Biological markers
- White light-emitting diodes (white LEDs)
- Circuit boards and new generation of televisions

BIODEGRADABLE POLYMERIC NANOCOMPOSITE

Parsa Polymer Sharif

www.parsapolymer.com

Description

This product is a biodegradable polymeric nanocomposite based on the synthetic and natural polymers, e.g. starch as a low-cost sustainable material. Certain nanomaterials have been included in this matrix to promote its mechanical and chemical properties.

Nanotechnology-driven advantages

The addition of nanomaterials to the biodegradable polymer compound has led to:

- A 200% reduction in the moisture absorption

The mechanical properties and biodegradability of the nano sample and control sample have been measured and reported below:

Measured properties	Control sample	Nano sample
Yield Strength (MPa) (According to ASTM D637)	15.06	16.41
Fracture Strength (MPa) (According to ASTM D637)	15.50	17.38
Elongation in Yield Point (%) (According to ASTM D637)	226	205.22
Elongation in Fracture Point (%) (According to ASTM D637)	235.04	249.37
Elastic Modulus (MPa) (According to ASTM D637)	350.51	430.76
CO2 Release Rate (gr) (According to ISO 14855-2)	0.586	0.901

Applications

- Packaging industry
- Automotive industry
- Piping
- Household appliances

ANTIBACTERIAL ABS MASTERBATCH

Parsa Polymer Sharif
Taban Andish Berjis

www.parspolymer.com
www.tabnano.co

Description

This product is an antibacterial masterbatch composed of ABS polymer and nanoparticles as the antibacterial component. It can be added to the pure ABS polymer matrix to make that antibacterial.

Nanotechnology-driven advantages

Adding a high concentration of antibacterial nanoparticles to the ABS polymer has resulted in:

- Developing a uniform polymeric masterbatch
- Emergence of strong antibacterial efficiency, especially against human pathogenic bacteria, i.e. E. Coli and S. Aureus

The antibacterial activity of the nano sample is evaluated and its results are summarized below:

Specimens	**Antibacterial Activity (According to INSO 13703)**
Acceptable standard limit	2 (equivalent to 99%)
Control sample	0 %
Nano sample (S.Aureus)	99.83 %
Nano sample (E.Coli)	99.95 %

Applications

- Drain-waste-vent (DWV) pipe systems
- Musical instruments
- Automotive trim components
- Automotive bumper bars
- Medical devices for blood access
- Enclosures for electrical and electronic assemblies

ANTIBACTERIAL POLYAMIDE MASTERBATCH

Parsa Polymer Sharif
Taban Andish Berjis

www.parspolymer.com
www.tabnano.co

Description

This product is an antibacterial polymeric masterbatch composed of polyamide as the matrix and nanoparticles as the antibacterial agent. It should be included in the pure polyamide in an arbitrary concentration to form the desired property.

Nanotechnology-driven advantages

The addition of nanoparticles to the pure polyamide matrix has resulted in:

- Emergence of antibacterial activity
- Preventing the growth and propagation of bacteria

The antibacterial activity is evaluated and its result is reported below:

Specimens	**Antibacterial Activity (According to INSO 10900)**
Acceptable standard limit	2 (equivalent to 99%)
Control sample	0
Nano sample (S.Aureus)	2.28
Nano sample (E.Coli)	2.26

Applications

- Textiles
- Automotive components and accessories
- Carpets
- Sportswear

ANTIBACTERIAL POLYETHYLENE (PE) MASTERBATCH

Parsa Polymer Sharif
Taban Andish Berjis

www.parspolymer.com
www.tabnano.co

Description

This product is a ceramic nanoparticles-modified polyethylene masterbatch, in which oxide nanoparticles are added to the polyethylene matrix.

Nanotechnology-driven advantages

The addition of ZnO nanoparticles to the polyethylene masterbatch has resulted in:

- Emergence of the antibacterial activity

The measured results for the antibacterial activity test of the nano sample are reported below:

Specimens	**Antibacterial activity (According to INSO 10900)**
Standard acceptable level	2
Control sample	0
Nano sample (E. coli)	2.48
Nano sample (S. aureus)	2.51

Applications

- Automotive parts and accessories
- Home appliances
- Containers
- Packaging
- Electrical/electronic devices
- Industrial applications

ANTIBACTERIAL POLYCARBONATE MASTERBATCH

Taban Andish Berjis

www.nanoproduct.ir

Description

This product is an oxide nanoparticle-containing polycarbonate masterbatch, taking advantages of excellent structural rigidity, appropriate level of transparency, and antibacterial activity.

Nanotechnology-driven advantages

The incorporation of nanoparticles into the polymer matrix has led to:

- Emergence of the antibacterial activity

The measured results for the antibacterial assay of the nano sample are summarized in the following table:

Sample type (ISIRI 10900)	**Antibacterial activity (According to INSO 10900)**
Acceptable standard level	2
Control sample	0
Nano sample (E. coli)	2.52
Nano sample (S. aureus)	2.57

Applications

- Electronic components
- Construction materials
- Data storage devices
- Automotive industry
- Aircraft industry
- Railway
- Security devices
- Medical applications

ANTIBACTERIAL POLYESTER MASTERBATCH

Taban Andish Berjis

www.tabnano.co

Description

This product is a polyester-based masterbatch with a controlled concentration of inorganic nanoparticles as an antibacterial agent.

Nanotechnology-driven advantages

The addition of nanoparticles to the masterbatch has led to:

- Emergence of antibacterial activity

The measured results for the antibacterial activity test of the nano sample are summarized below:

Specimens	Antibacterial Activity (According to INSO 10900)
Acceptable standard level	2
Control sample	0
Nano sample (E. Coli)	2.05
Nano sample (S. Aureus)	2.13

Applications

- Beverage bottles
- Packaging
- Yarn (textile industry)
- Clothing
- Home furnishings
- Industrial fabrics
- Polymeric computer parts
- Recording tapes
- Electrical insulation

ANTIBACTERIAL POLYETHYLENE TEREPHTHALATE (PET) MASTERBATCH

Parsa Polymer Sharif

www.nanoproduct.ir

Description

This product is a nanoparticles-modified PET polymeric masterbatch, which combines the appropriate characteristics of PET with antibacterial activity of the inorganic additive, deserving to be employed in the textile industry.

Nanotechnology-driven advantages

The incorporation of nanoparticles into the PET has resulted in:

- Emergence of antibacterial activity

The experimental results for the antibacterial activity test are reported below:

Specimens	**Antibacterial Activity (According to INSO 10900)**
Acceptable standard level	2
Control sample	0
Nano sample (S. Aureus)	2.79
Nano sample (E. Coli)	2.34

Applications

- Food packaging
- Beverage bottles
- Textile industry and rope production (using PET yarn)

AANTIBACTERIAL POLYPROPYLENE (PP)MASTERBATCH

Parsa Polymer Sharif www.nanoproduct.ir

Taban Andish Berjis www.nanoproduct.ir

Description

This product is a nanoparticles-containing polypropylene polymeric masterbatch, providing an appropriate resistance against human pathogenic bacteria, deserving to be used in a wide range of applications.

Nanotechnology-driven advantages

The modification of polypropylene with oxide nanoparticles has led to:

- Emergence of antibacterial activity

The measured results for the antibacterial activity test are summarized in the follow-

Specimens	Antibacterial Activity (According to INSO 10900)
Acceptable standard level	2
Control sample	0
Nano sample (E. Coli)	2.04
Nano sample (S. Aureus)	2.15

Applications

- Automotive accessories
- Home appliances
- Containers
- Packaging
- Electrical/electronic devices such as low-loss dielectric materials
- Industrial applications
- Piping systems
- Plastic moldings

FAMILY OF POLYMERIC MASTERBATCHES WITH HIGH MECHANICAL PROPERTIES

Pooya Polymer Tehran

www.nanoproduct.ir

Description

These products are high-density polyethylene-based masterbatches which are modified by well-dispersed oxide nanoparticles for obtaining favorable mechanical strength and flexibility.

Nanotechnology-driven advantages

The incorporation of nanoparticles with different concentrations into the polyethylene matrix has led to:

- Improved shear strength, hardness, and flexibility
- Increased elongation at failure and impact strength
- Decreasing the tensile strength as an unfavorable side effect

The mechanical properties of the nano sample have been measured and reported below. The tensile strength falls within the acceptable range after the unwanted reduction.

Measured Property		
Measured parameters	Control sample	Nano sample
Strength at yield point [MPa]	29.6±1.4	24.7±0.9
Elongation at yield point [%]	2±2	4.2±1.6
Fracture strength [MPa]	24.6±1.1	18.1±1.4
Elongation at failure [%]	16±2	39±12
IZOD Impact Strength [kJ/m2]	2.9±0.3	3.7±0.3

Applications

- Fabrication of containers to hold liquids such as milk
- Fabrication of water containers
- Fabrication of kitchen's polymeric instruments
- Fabrication of fuel-storing containers
- Fabrication of tubes and joints

SOUND-PROOF NANOCOMPOSITE ADDITIVE OF PIPING

Parsa Polymer Sharif

www.parsapolymer.com

Description

This product is a sound-proof polymer-based masterbatch in which inorganic nanoparticles are included to make the parts fabricated thereof sound-proof. While used for the fabrication of pipes and fittings, it can efficiently absorb the disturbing surrounding noises.

Nanotechnology-driven advantages

The addition of well-dispersed inorganic nanoparticles to the polymeric matrix in different concentrations has given rise to:

- Improved elastic modulus, impact resistance, and yield strength
- Increased toughness and stiffness of base polymer

Applications

- Fabrication of pipes and fittings for wastewater transfer systems

NANOPARTICLE-REINFORCED POLYPROPYLENE MASTERBATCH

Mohandesi Shamim Polymer Kosar

www.shamimpolymer.com

Description

This product is a nanoparticle-reinforced polypropylene matrix masterbatch, in which the incorporated nanoparticles serve as filler, contributing to an increase in the mechanical properties.

Nanotechnology-driven advantages

The addition of nanoparticles to the polymer has led to:

- Enhanced mechanical properties, including flexural and tensile strengths

The measured results for the mechanical properties of the nano sample are reported below:

Mechanical Properties (According to ASTM D6110:10)	Nano sample	Control sample
Impact Resistance (kJ/m2)	15.33	3.04

Applications

- Automotive components, such as bumper, instrument panels, and door trims

SERVICES AND INDUSTRIAL SUPPLIES

OFFERED SERVICE:
APPLYING DECORATIVE NANOSTRUCTURED COATINGS ON DIFFERENT SURFACES USING PVD SETUP

Pars PVD	www.parspvd.com
Tolerance	www.toleranceco.com
Atris	www.atrisataps.ir
Iran Bronze Steel	www.bronzesteel.ir
Kimiyae Saadat Sanat Modern	www.nanoproduct.ir
Ara Ceram	www.araceram.com
Noor Mehr Hoda	www.golfapvd.com
Negar Gostar Javid	www.negarestantile.com

Description

This product is a physical vapor deposition (PVD) system, enabling the settlement of golden ceramic compound with a variety of thicknesses on different substrates.

Nanotechnology-driven advantages

This system can deposit a thin film with a nanometric thickness. Such a coating is able to:

- improve the wear and corrosion resistance of underlying substrate
- reduce the erosion
- improve the apparent beauty of the underlying surface
- increase the surface hardness

Applications

- Equipment used in residential and office buildings such as sanitary faucets, handles and cabinet fittings
- Home appliances such as oven
- Bags, shoes, and accessories

NANOFIBERS CONTAINING POWER PLANT AIR FILTER

Nano Fanavaran Khavar www.nanokhavar.com
Azad Filter www.azadfilter.ir
Behran Filter www.behranfilter.com

Description

This family of products is an electrospun nanofibers-containing filter used in power plants to protect equipment against the contaminants. The nanofibers can entirely cover the surface of the filter, leading to a longer filter service lifetime.

Nanotechnology-driven advantages

The incorporation of the nanofibers into the filters has resulted in:

- Improved filtering efficiency
- Prolonged service time

The measured results for the filtration efficiency of the nano sample are reported below:

Specimens	Filtration efficiency using 0.3 µm dust (according to EN 779 standard)
Control Sample	23.39
Nano Sample	31.69

Applications

- Power plants

OFFERED SERVICE:
APPLYING ELECTROSPIN NANOFIBERS ON FILTER PAPERS

Fanavaran Nano Meghyas

www.fnm.ir

Description

This product is a thin layer of electrospun nanofibrous polymeric web which can be produced in the form of a nanoporous filter. It benefits a superior filtration capacity, lowest pressure drop in the passing air/liquid flow, and long lifespan.

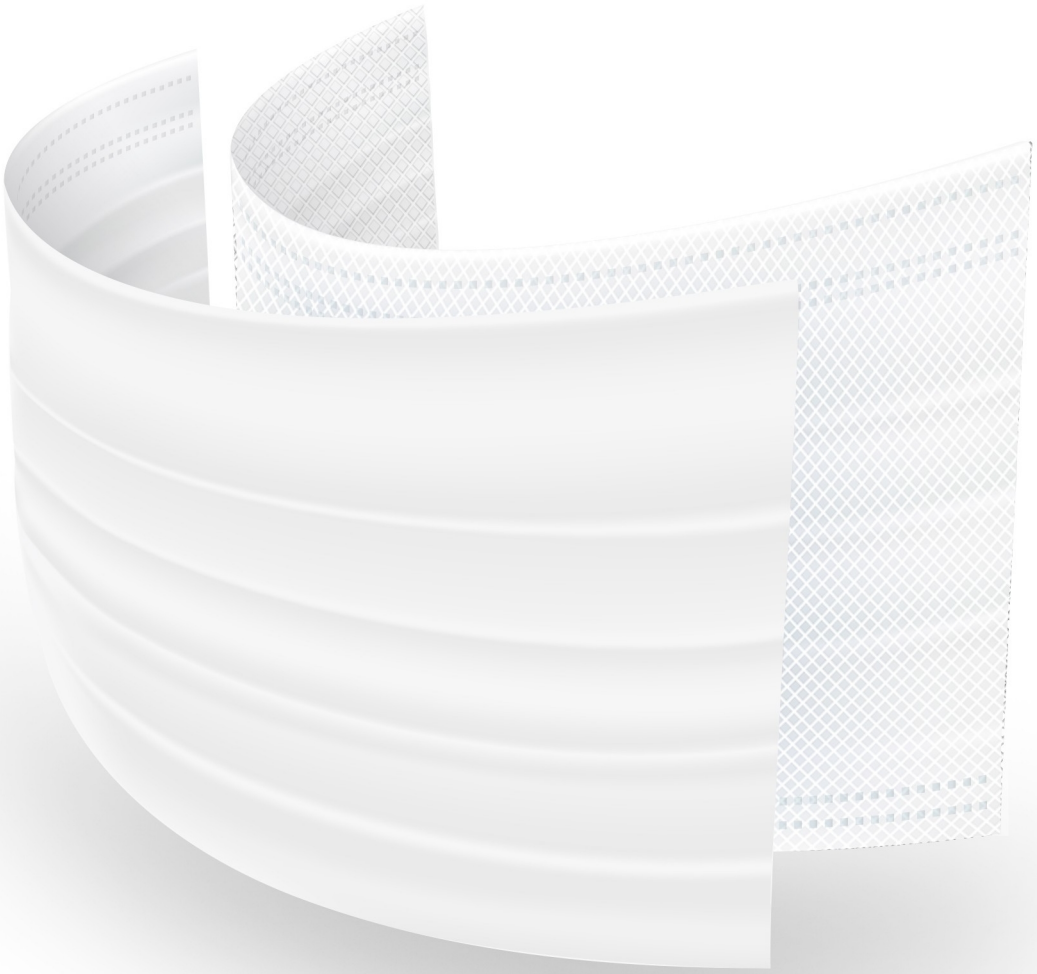
Nanotechnology-driven advantages

The covering of the surface of conventional air filters with a thin layer of the nanofibers or production of indepen-

- Improved filter efficiency
- Increased dust absorption capacity
- Negligible pressure drop in inlet air

Applications

- Production of respiratory face masks
- Air filter paper
- Separation of compounds from liquids



PIPES AND FITTINGS
SEAL WASHERS

Farapishtaz Hoonam

www.farapishtaz.com

Description

This product is a metal oxide-reinforced rubber nanocomposite that provides high mechanical properties deserving to be employed in pipe fittings.

Nanotechnology-driven advantages

The inclusion of metallic oxide nanoparticles in the polymer matrix can result in:

- Improved hardness by two times
- Diminished weight loss by 10 percent
- Decreased elongation by 110 percent

The measured values for these properties have been reported in the following table.

Measured Properties (According to Iranian National Standard 7491-1)	**Control sample**	**Nano sample**
Tensile strength (MPa)	8.18 ± 0.61	11.90 ± 0.50
Elongation at rupture point (%)	479 ± 38	576 ± 19
Hardness (Shore A)	55 ± 1	56 ± 1
Compressive fixity (%) - Temperature: 23 °C, time: 72 h	9.1 ± 0.2	10.1 ± 1.5
Compressive fixity (%) - Temperature: 70 °C time: 24 h	9.6 ± 0.5	13.1 ± 0.2
Compressive fixity (%) - Temperature: -10 °C, time: 72 h	5.3 ± 0.2	8.0 ± 0.6
Tensile strength changes after thermal timing (%) - Temperature: 70 °C, time: 7 days	1.22	-2.44
Elongation changes at rupture point after thermal timing (%) - Temperature: 70 °C, time: 7 days	-6.24	-11.63
Hardness changes after thermal timing (%) - Temperature: 700 °C, time: 7 days	2	2

Applications

- Sealing washers
- Pipe fittings

ZIRCONIA
CONVERSION COATINGS

Schiller Farayand Pars

www.schillerco.com

Description

This product is a nano-thick zirconia coating that can be applied on steel and aluminum substrates to provide a better corrosion performance. It is a lightweight, cost-effective, and non-hazardous coating that can tightly adhere to the underlying substrate.

Nanotechnology-driven advantages

The deposition of a nano-thick zirconia coating has led to:

- Improved corrosion resistance
- Better adhesion to the underlying metallic substrates

The results of the salt spray assay are summarized below:

Specimens	Corrosion	Rupture
Bare sample	6	5
Coated sample	10	10

*The classes 10 and 0 refer to highest and lowest resistance to the corrosion and delamination, respectively.

Applications

- Protection of metallic components from corrosive and chemical agents

ANTI-CORROSION
EPOXY & ALKYD PAINT

Nanoarisa Pooshesh

www.nanoarisa.com

Description

The first product is an alkyd paint, to which graphene oxide and some other carbon structures including graphene, graphite, and amorphous carbon are added. The second product is a nanoparticle-containing polymeric paint, in which the incorporated particles serve as the filler to promote the mechano-corrosion performance.

Nanotechnology-driven advantages

The inclusion of the nanostructured additives has resulted in:

- Higher corrosion resistance (according to ASTM B117-16 and ASTM D1654-16)
- Long-time durability
- Improved adhesion to the underlying substrate

Applications

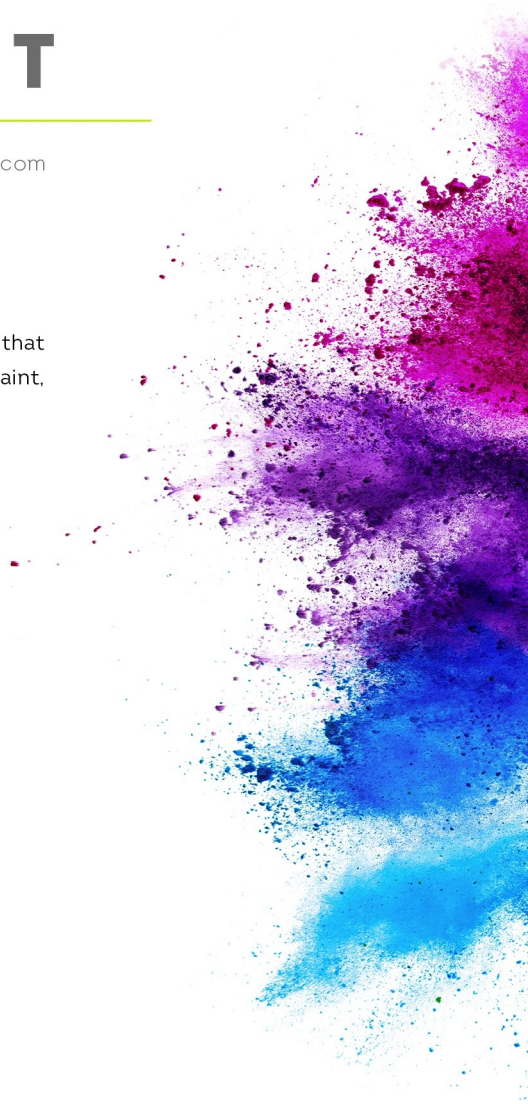
- Protection of metallic components from the corrosive and chemical agents


AGM12

ANTI-CORROSION POWDER PAINT

Fam Gostar Mahan

www.famgostarmahan.com



Description

This product is an anti-corrosion paint filled with oxide nanoparticles. It is proved that the additive has no obvious counterproductive effect on the visual color of the paint, making it suitable for various industrial fields.

Nanotechnology-driven advantages

The addition of the oxide nanoparticles to the paint has led to:

- Enhanced corrosion resistance

Applications

- Steel constructions in oil and gas industries
- Power stations
- Bridges
- Building structures
- Fish factories
- Cellulose mills

ELECTROSTATIC POWDER-BASED PAINT WITH SMOKE REDUCTION PROPERTIES

Kian Rangin Co.

www.kianranginco.com

Description

This product is an electrostatic powder-based paint composed of epoxy-polyester matrix and specific oxide nanoparticles. Since this product is more eco-friendly, it may be considered as an alternative to liquid paints.

Nanotechnology-driven advantages

The incorporation of oxide nanoparticles into the polymer matrix has led to:

- Enhanced thermal stability
- Decreased smoke volume after the paint curing

The smoke volume released during the thermal stability assay for the control sample and nano sample has been reported below:

Specimens	Smoke volume
Control sample	6
Nano sample	1

Applications

- Domestic appliances
- Automobile components
- Metal furniture
- Office and training equipment
- Heating and cooling equipment
- Aluminum profiles

RADIANT HEATER

Beh Faravaran Novin Aria Sarmad

www.nanoproduct.ir

Description

This product is a radiant heater, in which a metallic catalyst-containing layer is deposited on ceramic nanofibers. The surface temperature of the product can reach 500 oC and can offer low oxygen consumption and minimized CO and NOx emission.

Nanotechnology-driven advantages

Applying a nanometric catalytic layer on the fiber has resulted in:

- More efficient combustion

Applications

- Drying the insulating paint applied on cables and wires
- Thermo-forming (deformation by heating)
- Drying the painted glass
- Preheating the textile products
- Oil and gas industries (heating hoses in the petrochemical complex)
- Heating the industrial environments
- Drying the printing ink
- Employing in environments with flammable gas

FLUX-CORED WIRE WELDING

Nanostructured Advanced Materials Technologies Development (Namad Co.) www.namadnanotech.com

Description

This product is a flux-cored wire (FCW) which can deposit a thin film of hard alloying materials with nanometric phases on the external surfaces of steel instruments requiring high wear resistance.

Nanotechnology-driven advantages

While fabricated in the form of a cylindrical metal sheath and filled with different alloying elements, the formation of oxide nanoparticles in this product has resulted in:

- Improved wear resistance of formed coating

The wear resistance of the nano sample (i.e. the substrate with a hard coating) has been measured and its result is reported below:

Specimens	Weight loss in wear test (gr)
Nano sample	0.157
Control sample	0.632

Applications

- Deposition of a hard coating on instruments
- Reconstruction or repairing of hard coatings on instruments
- Deposition of a hard coating on the devices requiring high wear resistance in mining industry

WELDING ELECTRODE

AMA Industrial Co. www.ama-co.com

Description

This product is a moisture-resistant alkaline welding electrode whose coating is included by oxide nanoparticles. The new coating prevents the hydrogen absorption on the electrode surface and avoids the hydrogen cracking in humid media.

Nanotechnology-driven advantages

The incorporation of nanoparticle into the shielding coatings of welding electrodes has resulted in:

- Making the electrode moisture-resistant
- Reducing the hydrogen absorption on the electrode surfaces
- Preventing the hydrogen cracking in the parts welded in humid media

The moisture content of the shielding coating for the nano sample has been evaluated and its result is reported below:

Specimens (According to AWS A5.1)	Control sample	Nano sample	Control sample	Nano sample
Diameter (mm)	4	4	3	3
Moisture content of coating (wt. %)	1.62	0.17	1.23	0.16

Applications

- Welding in humid media
- Welding of metallic parts which are prone to hydrogen cracking


E 6011

ANTI-SPATTER SOLUTION FOR WELDED PARTS

Parto Behtab Shimi Alborz

www.behtabshimi.ir

Description

This product is a nanoparticle-containing solution which can be applied on the metallic parts before welding. It can form a protective layer on its underlying substrate and prevent the adhesion of sparks and molten drops spattering around.

Nanotechnology-driven advantages

Applying a thin layer of the nanoparticle-containing solution on the welding part may result in:

- Emerging the anti-spatter property in welding
- Decreasing the interfacial adhesion between welding-arisen molten drops and exterior surfaces of welded part

The anti-spatter property of the applied coating has been evaluated and its results are summarized below:

Specimens	Control sample
Control sample 1 (i.e. sample with no coating)	• A large population of spatters was observed on the substrate with high adhesion strength. • Sandblasting is required to remove spatters.
Control sample 2 (i.e. sample with a nanoparticle-free anti-spatter coating)	• A large population of spatters was observed on the substrate with high adhesion strength. • Sandblasting is required to remove spatters.
Control sample 3 (i.e. sample with commercial anti-spatter coating)	• A limited population of spatters was observed with lower adhesion strength. • Sandblasting is required to remove spatters completely.
Nano sample (i.e. sample with a nanoparticle-containing anti-spatter coating)	• A trivial amount of spatters was formed on the substrate. • There is no need for sandblasting to remove the spatters.

Applications

- Prevention of unwanted spatters to adhere to surrounding parts

REFRACTORY CASTING MASS

Description

This product is a casting refractory based on ceramic materials in which nanoparticle-containing colloidal binder is used with an appropriate stability. It is able to efficiently bind the ceramic precursors to form final bulk refractory units and coatings.

Nanotechnology-driven advantages

The addition of ceramic nanoparticles to the binder of this refractory has resulted in:

- Enhanced gelation properties
- Improved strength

The measured results for the compressive strength of the nano sample are reported below:

Specimens	Value in MPa (According to ASTM C150)
ontrol sample	43
Nano sample	117

Applications

- Casting factories
- Petrochemical plants
- Steel Mills

REFACTORY & HIGH TEMPERATURE NANOPARTICLE CONTAINING CERAMIC FOR GAS TURBINE COMBUSTION CMABER

Atlasceram Kavir

www.atlasceram.ir

Description

This product is a refractory ceramic matrix nanocomposite which successfully tolerates the elevated temperatures (from 1100 to 1850 K) and high pressures (from 5 to 10 atm). It is highly corrosion-resistant, endures strong thermal shock, and benefits a long lifespan.

Nanotechnology-driven advantages

The following improvements have emerged through adding hard nanoparticles to the ceramic matrix:

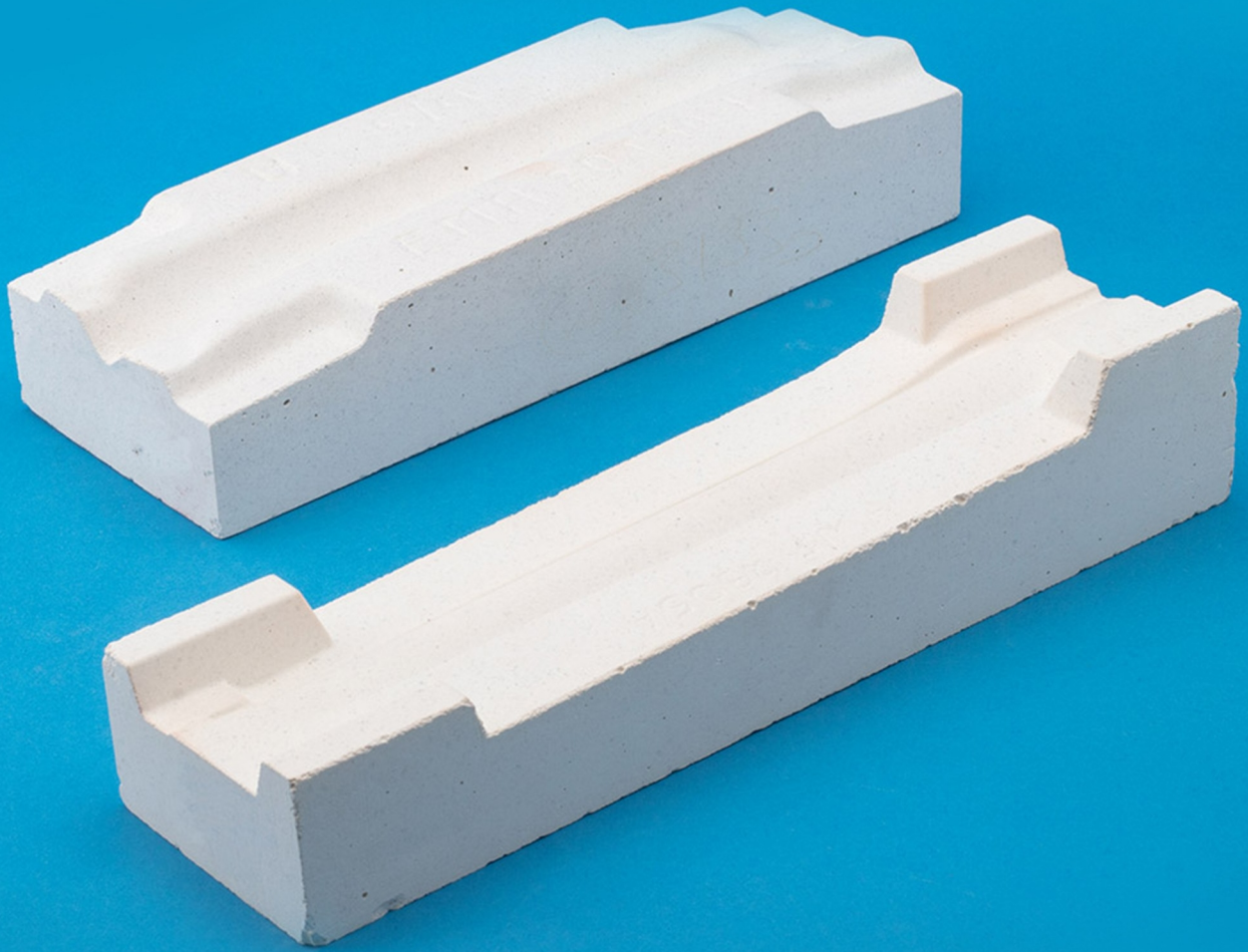
- Increased mechanical strength
- Better dimensional accuracy
- Proper thermal shock resistance
- Longer lifetime at elevated temperatures and high pressures

The shock sensitivity test has been performed on the nano sample and its results are reported below:

Crack length after applying thermal shock for 30 cycles	**Maximum length = 18 mm**
	Average length = 12 mm

Applications

- Internal walls of combustion chamber in gas turbines
- As crucibles and melt paths in ferrous and non-ferrous metals industries



CORROSION RESISTANT COLLECTOR

Nano Abkar Isatis

www.inp-coating.com

Description

This product is an aluminium alloy-based collector whose external surfaces are coated by corrosion-resistant oxide layer. While used to collect the standing or running water or divide that into separate building units, it benefits high corrosion and abrasion resistances.

Nanotechnology-driven advantages

The generation of an oxide layer on the aluminium matrix has resulted in:

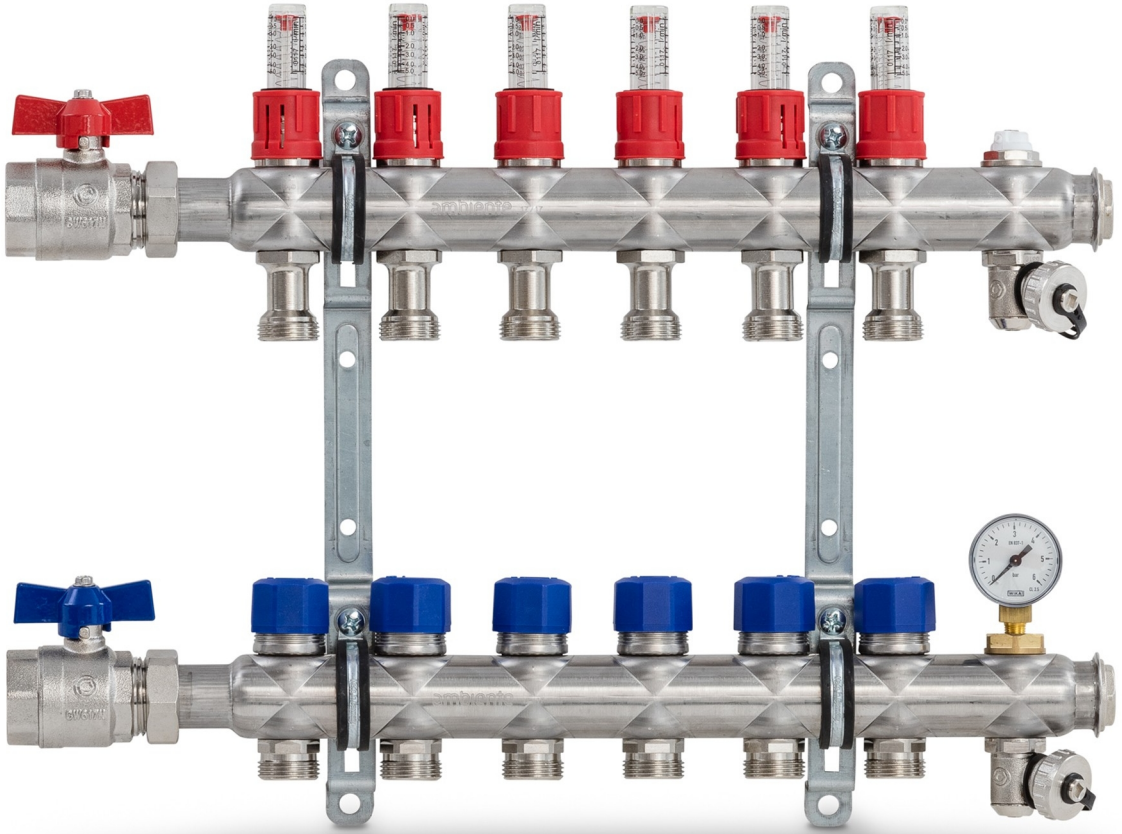
- Increased corrosion resistance

The corrosion resistance of the nano sample has measured and its results are reported below:

Specimens	**Corrosion Resistance (KΩ/cm²)**
Nano sample	351.577
Control sample	1.146

Applications

- Collection of water or its distribution in independent units



Offered Service:
APPLYING NANOSTRUCTURED COATINGS ON DIFFERENT SURFACES USING PVD SETUP

Sevin Plasma Surface Engineering www.sevinplasma.ir

Description

This product is a physical vapor deposition (PVD) system, enabling the settlement of different materials with a variety of thicknesses on different substrates in a single or stacking form. For instance, it is able to deposit a sequence of multiple layers of TiN/TiAlN, with desired interfacial adhesion and high crack propagation resistance.

Nanotechnology-driven advantages

This system can deposit TiN and TiAlN in a z-stacking form with a nanometric thickness. Such a multilayer coating benefits:

- Good interfacial adhesion between deposited layers
- Desired adhesion to the underlying substrate
- High abrasion resistance and hardness
- Lower crack nucleation possibility due to lower residual stress

Applications

- Deposition of different materials on different substrates based on customer's demand
- R&D for designing or selecting best coating and surface treatment for different operational conditions
- R&D for the evaluation and characterization of nanostructured hard coatings and layers
- Deposition of hard coatings on tools (such as TiN, TiAlN, CrAlN and TiAlSiN)
- Coating of different instruments and parts in automobile industry (such as TiC, DLC, and CrNi)
- Offering the professional training to companies and industries in the surface engineering field

Offered Service:
DECORATIVE COATINGS

Pars PVD	www.parspvd.com
Tolerance	www.toleranceco.com
Atrisa	www.atrisataps.ir
Iran Bronze Steel	www.bronzesteel.ir
Kimiyae Saadat Sanat Modern	www.nanoproduct.ir
Ara Ceram	www.araceram.com
Noor Mehr Hoda	www.golfapvd.com
Negar Gostar Javid	www.negarestantile.com

Description

This product is a physical vapor deposition (PVD) system, enabling the settlement of a hard and wear-resistant thin film on a variety of substrates for decoration purposes. This coating can be applied on different substrates in different thicknesses.

Nanotechnology-driven advantages

This system can deposit a thin film with a nanometric thickness and provides the following benefits:

- Favorable and smooth appearance for decoration applications
- High hardness and wear resistance
- High resistance to abrasion, corrosion, and erosion

Applications

- Hard protective coatings for industrial parts
- Diffusion barriers for semiconductor industry
- Thin films for optic applications
- Pipelines, sporting goods, home appliances, metal bars, frames, and knobs
- Instruments and devices which are often exposed to wear, erosion and corrosion during use and cleaning

CONDUCTIVE PEN
FOR EDUCATIONAL AND HANDCRAFT PURPOSES

Shimi gostar nano mad

www.nanomad.co

Description

This product is a conductive pen or marker containing metal nanoparticles for handcraft, educational and electrical applications. The ink is diluted by water as solvent to make it environmentally friendly and easy to use.

Nanotechnology-driven advantages

The addition of metal nanoparticles into the ink of the fabricated pen has led to:

- A significant reduction in materials consumption and resultant lower spot price
- A significant reduction in the roughness and swelling of the written surface
- Enhanced conductivity

Applications

- Handcraft industry
- Kid education
- Electrical circuit design
- Solar cells

ANTI-REFLECTIVE SUNGLASSES AND MULTI-PURPOSE ONE

Electro Optic Sairan Industries Co.

www.ioico.ir

Description

The first product is an anti-reflective sunglass on which a nanostructured coating is applied to filter the harmful UVB radiation from the eyes. The second product is a multi-purpose sunglass with a sport frame model which can be used for both men and women with all face forms.

Nanotechnology-driven advantages

Applying a nanometric coating on the sunglass has resulted in:

- Increasing the light transmittance up to 98 percent
- Filtering the detrimental UVB radiation
- Protecting the eye from the surrounding harmful rays

The reflectance percent of the visible light for this spectacle before and after applying the nano-thick coating is reported below:

Specimens	Percent of visible light transmission
Control sample (Lens before applying the coating)	93%
Nano sample (Lens after applying the coating)	98.5%

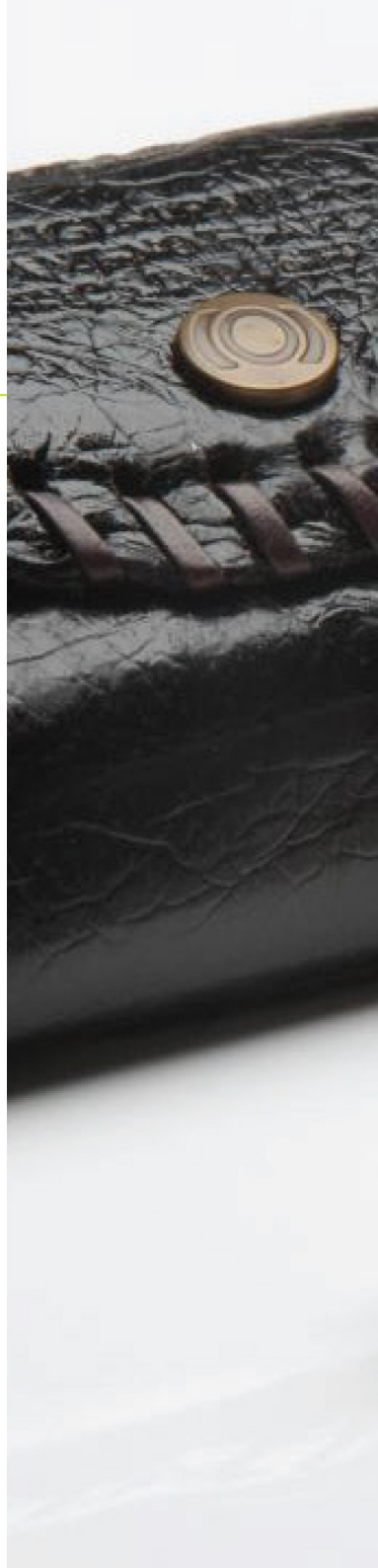
Applications

For the first product:

- UVB protection sunglasses

For the second product:

- Ecotourism
- Exercise
- Walking in sunny, cloudy, foggy, snowy and semi-cloudy weather



BINOCULARS
WITH ANTI REFLECTIVE LENS

Noavaran Modabber Sanat

www.nms-co.com

Description

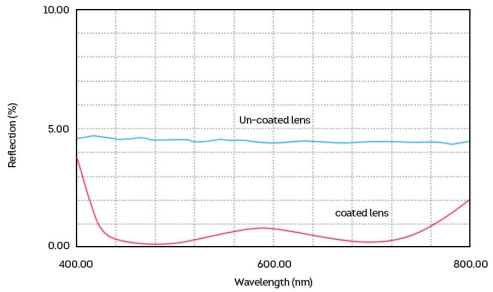
This product is a binocular in which a nano-thick thin film is deposited over the lenses, aimed at decreasing the light reflection.

Nanotechnology-driven advantages

Applying a nano-thick coating over the lenses leads to:

- Emergence of the anti-reflection property

The following curves illustrate the measured reflection percent at various wavelengths for the nano sample:



Applications

- Binoculars

H E A T S I N K

Nano Abkar Isatis

www.inp-coating.com

Description

This product is a heat sink whose surfaces are covered by thin layer of nanoporous alumina through anodizing. It benefits a better corrosion resistance and heat transfer kinetics.

Nanotechnology-driven advantages

The following improvements have been made through anodizing exterior surfaces of the heat sink and forming a thin layer of nanoporous alumina:

- Increased corrosion resistance
- Better heat transfer owing to high surface area-to-volume ratio
- Improved thermal emission coefficient

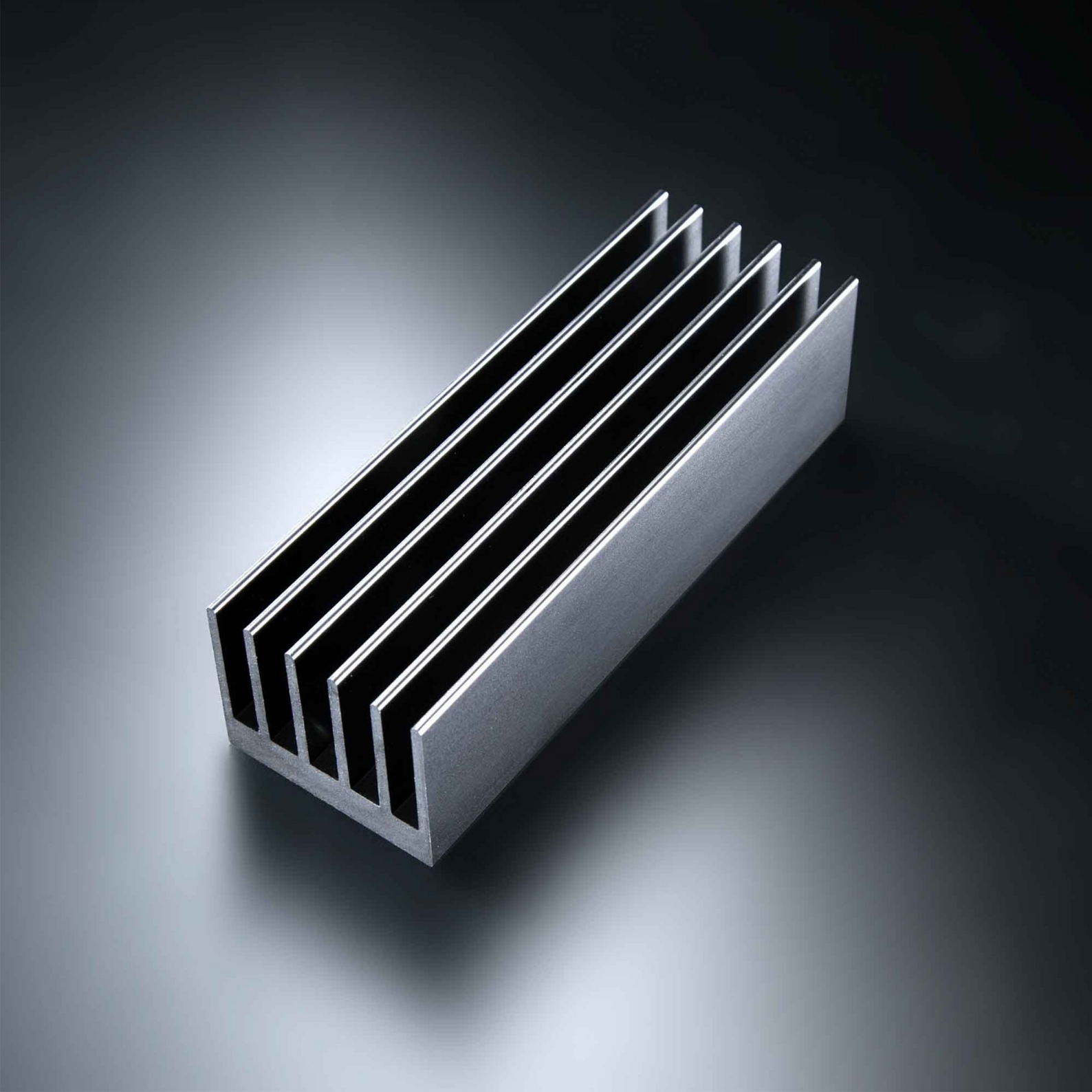
The corrosion resistance and thermal emissivity of the nano sample have been measured and their results are reported below:

Specimens	**Average thermal emissivity coefficient**	**Corrosion resistance (Ω/cm²)**
Control sample	0.5	1146.63
Nano sample	0.98	351577

Applications

Cooling of:

- Microprocessors
- Light-emitting diode lamps
- Solders



www.nano.ir

www.INDnano.ir

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